EE524 Machine Learning Lab

Assignment 2

16 August 2022

1 Linear Algebra & Optimization

1. For the given matrices, find their inner product and the angle between them.

$$A = \begin{bmatrix} 9 & 8 & 7 \\ 6 & 5 & 4 \end{bmatrix} \quad B = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix}$$

2. A matrix is said to be positive semi-definite (PSD) when $x^T A x \geq 0$ for all $x \in R^n$. If the eigenvalues are all greater than or equal to 0 then also the matrix is said to be PSD. Find the eigenvalues and eigenvectors of the following matrices and comment on which of them are PSD:

$$\begin{bmatrix} 0.5 & 0 \\ 0 & 0.5 \end{bmatrix}, \begin{bmatrix} 9 & 5 \\ 5 & 4 \end{bmatrix}, \begin{bmatrix} 1 & -0.5 \\ -0.5 & 1 \end{bmatrix}, \begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix}$$

3. Perform Singular Value Decomposition (SVD) for the matrix $A = \begin{bmatrix} 3 & 3 & 2 \\ 2 & 3 & -2 \end{bmatrix}$.

4. Read the iris file (provided with the assignment) into a matrix with all the features (attributes). Each column of the matrix should represent a vector. Compute the co-variance matrix of the vectors and find the eigenvalues and eigenvectors, print them in descending order.

2 Probability Distributions

1. Plot the PDF for the following distributions. Vary the parameters to get at least 3 different realizations of each: Uniform (a,b), Exponential λ), Gaussian (μ, σ), Standard Normal (0,1). Calculate the mean and plot it with the PDF in a single plot for one distribution.